

REMARKS

Reconsideration of the above-identified patent application in view of the following remarks is respectfully requested.

Claims 1-10, 13-24, and 27-33 are in this application.

The claims before the Examiner are now directed to a system and a method for automatic online optimization of a process, wherein the process control model is able to generate its own initial data and then continue to optimize the process by setting appropriate input combinations for desired outputs.

Following the Examiner's comments on claim construction, the independent claims have been amended to clarify the point that there is an initial experimental operation of the process to obtain initial data in the most efficient way possible. The different independent claims specify different characteristics generally based on the DOE methodology. The controller, armed with the initial data then proceeds to carry out online optimization of the process in regular operation, using the resulting process control model. Regular operation differs from experimental operation in that in regular operation the process is set to input points that result in the desired outputs. Experimental operation involves operating the process at extreme points which are selected so as to cover the input space so that a regressive model of the entire input space can be defined.

DOE methodology does not intrinsically involve construction of a predictive control model, although it does allow for regression over an input space. None of the prior art teaches using DOE to provide initial data to a predictive control model and then using the same equipment to actually carry out the process. None of the prior art teaches the further preferred embodiments of using further operation of the model to fill in the data initially covered by regression from the DOE provided initial data.

Referring now to the Examiner's explicit rejections and objections:

Claim Rejections 35 USC 101

Claim 15 is rejected under 35 USC 101 because the claimed invention is directed to non-statutory subject matter. The claim has been amended to relate to experimental and regular operation of a process using inputs set according to predictive outputs from the model. The process carries out online optimization of the process in regular operation mode.

It is believed that this amendment allows the claim to be seen as relating to a statutory method of manufacture.

Claim Objections

Claims 9 and 21 are objected to as being in improper Markush group format.

Appropriate correction has been made.

Claim Rejections 35 U.S.C 102(b)

The Examiner has rejected claims 1-10 13-24 and 27-33 under 35 U.S.C 102(b) as being anticipated by "Conducting Experiments with Experiment Manager, M. Angel pp 535-541 Proceedings 1996 Winter Simulation Conference ACM 1996. The Examiner's rejection is respectfully traversed in light of the amendments described above.

It has already been noted that all the claims now clearly refer to two stages, experimental running of the process to obtain predictive data, and actual running of the process to obtain desired outputs. Angel refers only to the first stage, as is abundantly clear from his title, "Conducting Experiments...". Angel does not concern himself with using the data he has obtained to build a predictive model for a process nor to carry out actual control of the process using the data he has obtained. It is noted that a predictive model for a process

is a model that ties together inputs with expected outputs. This is not the same as modeling the process or simulating the behavior of the process model as discussed by Angel since he *simulates* the process in order to understand its *overall* behavior. In other words he attempts to obtain a *general understanding* of the process. The general understanding may be used in designing new equipment or learning better how to run the process. This is not the same as process control using a *predictive* model, where the aim is in principle much more basic, but is technologically applicable, namely to select inputs to a system which will produce the necessary outputs. In other words Angel is interested in modeling general behavior, whereas the present invention is interested in setting actual inputs to produce actual outputs corresponding to model predictive outputs.

It is therefore believed that claims 1-10, 13-24 and 27-33 are novel and inventive in light of Angel.

35 U.S.C 103(a) Rejections – U.S. 5,781,430 (Tsai) in view of U.S. 6,373,033 (de Waard)

The Examiner has rejected claims 1-10, 13-24 and 27-33 under 35 U.S.C 103(a) as being unpatentable over Tsai in view of de Waard. The Examiner's rejection is respectfully traversed. The independent claims have been amended to recite process control in regular process operation using a predictive model, wherein data is obtained for the model in an initial experimental phase in which the process is operated over a minimal number of experiments to obtain maximal usable data.

Neither Tsai nor de Waard teach process control for regular operation using a predictive model, which predictive model obtains data using an experimental phase of process operation.

As discussed above Tsai teaches a method that is not a method of process control to which the present invention belongs, but a method in the entirely different field of *optimizing* settings of a *steady state* process that subsequently runs without intervention.

De Waard discloses a predictive control system using parameterized equations to simulate the process. De Waard gathers extensive experimental data (starting c. 19 l. 55, specifically c. 20 l. 14 and c. 21 l. 46), as discussed in the previous response. De Waard does not teach the use of orthogonally placed or DOE preselected points of the input space in order to select the experiments. Neither does Tsai teach this feature.

Tsai and de Waard do not teach all of the features of the rejected claims, neither separately nor in combination. Further, there is no evidence that one skilled in the art would be motivated to combine the teachings of de Waard from the field of process control with any aspect of the unrelated field of input determination for a process including only controllable parameters, and even if he did so he would not arrive at the combinations of features taught in the various independent claims.

Conclusion

Independent claims 1, 15 and 24 each contain combinations of features that are neither anticipated by nor obvious in light of the art. Applicant is of the opinion that independent claims 1, 15 and 24, and consequently all claims dependent therefrom, are in condition for allowance.

All the issues raised by the Examiner have been dealt with and applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

Martin O. Moynihan

Martin Moynihan

Registration No. 40,338

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